CLAIMS

1. A modular cellular wireless communication base station comprising:

a plurality of active radiator modules located at a desired antenna location, each module comprising at least one antenna for transmitting and receiving, a transmitter comprising a power amplifier, and a receiver;

a beam forming network controlling relative amplitudes and phases of each of said modules;

an RF front end transmitting over a low power link with said plurality of active radiator modules via said beam forming network and receiving over a lower power link via a low noise amplifier; and

a delay diversity module that provides a transmission CDMA delay diversity.

2. A modular cellular wireless communication base station according to claim 1 and wherein said delay ~~diversity module~~ comprises a SAW delay line and an amplifier that compensates for a delay line insertion loss.

3. A modular cellular wireless communication base station according to claim 1 and wherein said delay diversity module is connected at a transmission beam forming network input.

4. A modular cellular wireless communication base station according to claim 1 and wherein said delay diversity module is connected at an active antenna transmission input.

5. A polarization diversity and matching system for cellular radio, comprising:

a dual polarized antenna pair at a base station, each antenna comprising an appropriate receive channel; and

a signal combining and control circuitry that adds polarization diversity to a base station receiver.

6. A system according to claim 5 wherein said circuitry is characterized by two time constants, wherein a fast circuit adapts to fading signals on a received reverse link and changes weights of two antennas, and a slow circuit follows physical movements of a mobile station and averages fading of a received signal.

7. A system according to claim 6 wherein said slow circuit is driven by information from received signals and matches transmitted signal polarization to that of an incoming signal.

8. A system according to claim 6, wherein said slow circuit detects an average polarization vector direction from received signals and produces an output matched signal from said received signals according to said average polarization vector direction.

9. A system according to any of claims 5 - 7 wherein a signal from two receiving antennas are weighed by weights controlled by said signal combining and control circuitry, said weights being fed into a transform circuit that transforms said weights according to polarizations of said transmitting antennas and differences in gain.

10. A system according to any of claims 5 - 9 and comprising a low-pass filter that averages fast control variations and responds only to slow variations resulting from a physical attitude change of said station.

11. A system according to claim 10 wherein a transmit chain is split into two branches, and weights are applied to each said branch for each said receive channel.

12. A system according to claim 10 wherein a transmit chain is split into two branches that operate at a fixed power, and wherein a phase of one of the branches is switched between 0^0, $+90^0$, $+180^0$, -90^0, and -180^0.

13. A method for increasing transmission gain to a mobile station of a mobile communications system, the method comprising:

substantially ~~simultaneously transmitting from two transmit~~ antennas so as to form a radiation pattern that is characterized by a plurality of radiation lobes, each lobe being characterized by a width inversely proportional to a distance between said ~~antennas~~, an amplitude of said lobes being bound by said radiation pattern of said antennas;

determining a transmission direction to a mobile station; and

aiming said pattern so as to produce a maximum in said transmission direction, thereby increasing transmission gain to said mobile station, and reducing scattering into said mobile station from foreign objects.

14. A method according to claim 13 and wherein said step of determining a transmission direction comprises amplifying and filtering a signal from each antenna, splitting said signals, and changing a phase of said signals relative to one another so as to determine said direction.

15. A method according to claim 13 and wherein said step of determining a transmission direction comprises extracting direction information from a receive diversity control for a given antenna channel and correcting for a difference in frequency.

16. Apparatus for increasing transmission gain to a mobile station of a mobile communications system, said apparatus comprising:

two transmit antennas positioned together with a pair of diversity receive antennas, wherein said two transmit antennas transmit substantially simultaneously so as to form a radiation pattern that is characterized by a plurality of radiation lobes, ~~each lobe being~~ characterized by a width inversely proportional to a distance between said transmit antennas, an amplitude of said lobes being bound by said radiation pattern of said transmit antennas; and

aiming apparatus that aims said pattern so as to produce a maximum in a transmission direction to a mobile station, thereby increasing transmission gain to said mobile station, and reducing scattering into said mobile station from foreign objects.

17. Apparatus according to claim 16 wherein said transmit antennas and said receive antennas comprise a plurality of active radiator module arrays.

18. Apparatus according to claim 16 or claim 17 wherein said transmit antennas are spaced by a distance as required to avoid correlation between fading of signals from remote mobile stations within a coverage area.

19. A system for improving coverage of a wireless transceiver comprising:

means for transmitting an outgoing signal in two orthogonal polarized states; and

means for controlling the polarization of at least one of said states, thereby polarizing said outgoing signal at any desired direction.

20. A system according to claim 19, wherein said means for transmitting comprise a plurality of antennas,

wherein at ~~least one of said antennas transmits a portion of said~~ outgoing signal in a predetermined polarization vector, and

wherein at least another of said antennas transmits a portion of said outgoing signal in a ~~polarization~~ vector which is orthogonal to said predetermined polarization vector.

21. A system according to claim 19 wherein said controlling means constantly change the polarization direction of said outgoing signal.

22. Method for improving coverage of a wireless transmitter comprising the steps of:

receiving an outgoing signal;

constantly changing the direction of the polarization vector of said outgoing signal, according to a polarization change pattern; and

transmitting said polarized outgoing signal.

23. The method according to claim 22, further comprising the step of determining said polarization change pattern.

24. The method according to claim 23, wherein said polarization change pattern is determined from the characteristics of said wireless transmitter.

25. The method according to claim 23, wherein said polarization change pattern is determined from the characteristics of the area covered by said wireless transmitter.

26. The method according to claim 25, further comprising the step of determining the characteristics of said area.

27. The method according to claim 22, wherein said polarization change pattern is selected from the list consisting of:

a linear polarization change pattern;

a cyclic polarization change pattern;

a non-linear polarization change pattern; and

a random polarization change pattern.

28. A repeating device comprising:

a donor antenna for linking to a transmitting antenna of a base station;

two orthogonally polarized donor antennas, for linking to two orthogonally polarized receive antennas of said base station;

a subscriber-side antenna, for linking to at least one mobile transceiver;

two orthogonally polarized subscriber-side antennas, for linking to said at least one mobile transceiver;

a first amplifier, connected between said donor antenna and said subscriber-side antenna, for amplifying a signal received by said donor antenna prior to transmitting said signal via said subscriber-side antenna;

a second amplifier, connected between one of said orthogonally polarized donor antenna and one of said orthogonally polarized subscriber-side antenna, for amplifying a signal received by said one orthogonally polarized subscriber-side antenna prior to transmitting said signal via said one orthogonally polarized donor antenna; and

a third amplifier, connected between the other of said orthogonally polarized donor antenna and the other of said orthogonally polarized subscriber-side antenna, for amplifying a signal received by said other orthogonally polarized subscriber-side antenna prior to transmitting said signal via said other orthogonally polarized donor antenna.

29. A repeating device comprising:

two orthogonally polarized donor transmit antennas, for linking to two orthogonally polarized receive antennas of a base station;

two orthogonally polarized donor receive antennas, for linking to two orthogonally polarized transmit antennas of said base station;

two orthogonally polarized subscriber-side transmit antennas, for linking to at least one mobile transceiver;

two orthogonally polarized subscriber-side receive antennas, for linking to said at least one mobile transceiver;

a first amplifier, connected between one of said orthogonally polarized donor transmit antenna and one of said orthogonally polarized subscriber-side receive antennas, for amplifying a signal received by said one orthogonally polarized subscriber-side receive antenna prior to transmitting said signal via said one orthogonally polarized donor transmit antenna;

a second amplifier, connected between the other of said orthogonally polarized donor transmit antennas and the other of said orthogonally polarized subscriber-side receive antennas, for amplifying a signal received by said other orthogonally polarized subscriber-side receive antenna prior to transmitting said signal via said other orthogonally polarized donor transmit antenna;

a third amplifier, connected between one of said orthogonally polarized donor receive antenna and one of said orthogonally polarized subscriber-side transmit antennas, for amplifying a signal received by said one orthogonally polarized donor receive antenna prior to transmitting said signal via said one orthogonally polarized subscriber-side transmit antenna; and

a fourth amplifier, connected between the other of said orthogonally polarized donor receive antenna and the other of said orthogonally polarized subscriber-side transmit antennas, for amplifying a signal received by said other orthogonally polarized donor receive antenna prior to transmitting said signal via said other orthogonally polarized subscriber-side transmit antenna.

30. Method for repeating a randomly polarized signal, comprising the steps of:

receiving said signal at a first and a second states, thereby providing a first portion of said signal, received at said first polarization state and a second portion of said signal, received at said second polarization state; and

transmitting said first portion according to said first polarization state and said second portion according to said second polarization state.

31. The method according to claim 30, further comprising the step of amplifying said first and second portions, before said step of transmitting.

32. The method according to claim 30, wherein said first polarization state is orthogonal to said second polarization state.

33. A repeating device comprising:

a donor side transceiver section;.

a subscriber side transceiver section; and

amplification means connected between said donor side transceiver section and said subscriber side transceiver section,

said donor side including a plurality of donor side transceiver elements, transmitting outgoing signals in a first non-correlated manner, and

said subscriber side including a plurality of subscriber side transceiver elements, receiving incoming signals in a second non-correlated manner.

34. The repeater according to claim 33, wherein at least one of said first non-correlated manner and said second non-correlated manner incorporates space diversity.

35. The repeater according to claim 33, wherein at least one of said first non-correlated manner and said second non-correlated manner incorporates polarization diversity.